

FTI Overview

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**Federal Aviation
Administration**



Topics

- **FTI-2 Focus Areas/ Challenges**
- **FTI Program & Contract Overview**
- **FTI Architectural Overview**
- **Overview of Services Provided by FTI**
- **FTI NAS Operational and Mission Support Networks**
- **Enterprise Messaging Services**
- **FTI Security Architecture**
- **Near-Term FTI Challenge**
 - TDM-to-IP Migration
- **Summary**

FTI-2 Focus Areas / Challenges



FTI-2 Focus Areas

- **Ensuring a competitive landscape**
- **Leveraging technology and market place innovation**
- **Defining a cost recovery model that balances the risk between the FAA and the service provider**
- **Clearly defining the FAA's requirements**
 - Includes balancing the need for continued support of the FAA's legacy systems versus the needs of future programs

FTI-2 Challenges

- **Magnitude of the service inventory \ number of sites affected**
 - Parallel operating costs while transitioning 25,000+ services
- **Meeting FAA's unique requirements**
 - Commercial service offerings currently do not meet the FAA's performance and security service requirements
 - Survivability protection from "6-sigma" events
- **Diverse mix of service requirements**
 - FAA is exploring options to reduce the number of unique interfaces to simplify the FTI-2 transition and gain economies of scale
 - Enterprise Messaging / other value added infrastructure services
- **Time Division Multiplexing (TDM) – based services phase-out**
 - Wireless solutions not yet capable of meeting availability, latency and timing requirements

FTI Program & Contract Overview



FTI Program & Contract Overview

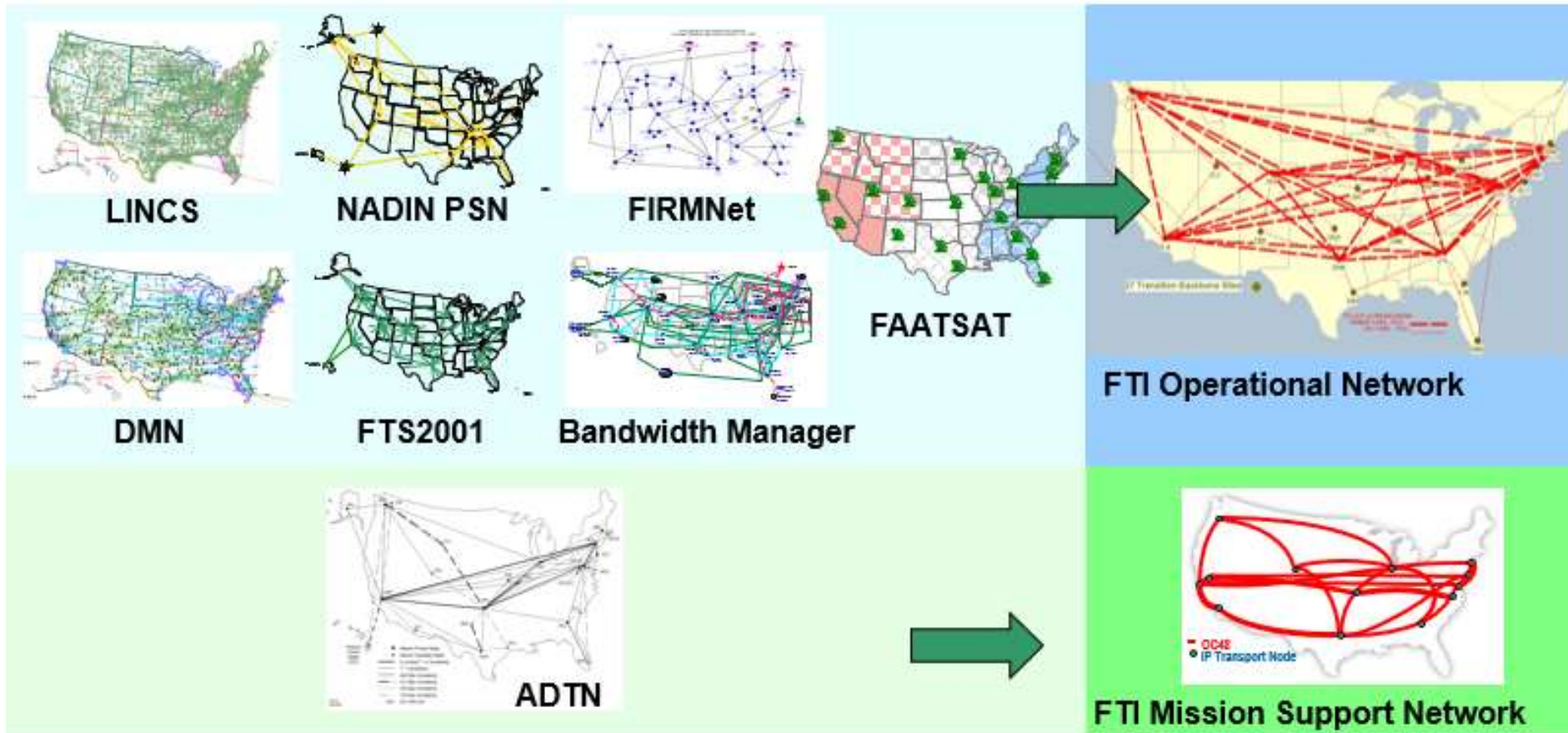
- **FAA Telecommunications Infrastructure (FTI) is a performance-based services contract through which the FAA acquires the majority of the telecommunication services it requires**
- **Awarded in July 2002 to team led by Harris Corporation**
- **15-year period of performance, \$3.5B ceiling**
 - 5-year base period to cover transition phase
 - Ten 1-year options

Before FTI

- **The FAA had numerous overlapping networks**
 - Some leased, some FAA-owned, and some a combination of both
- **Most had their major nodes at the ARTCCs**
- **Each network was tailored to meet the needs of a specific subset of users**
 - Typically based on the communications protocol they were using
- **Each network was separately managed and operated**
 - Different ordering processes, network management systems, and invoicing formats
- **Contracts lacked mechanisms to incentivize performance**



FTI Consolidated Multiple Networks



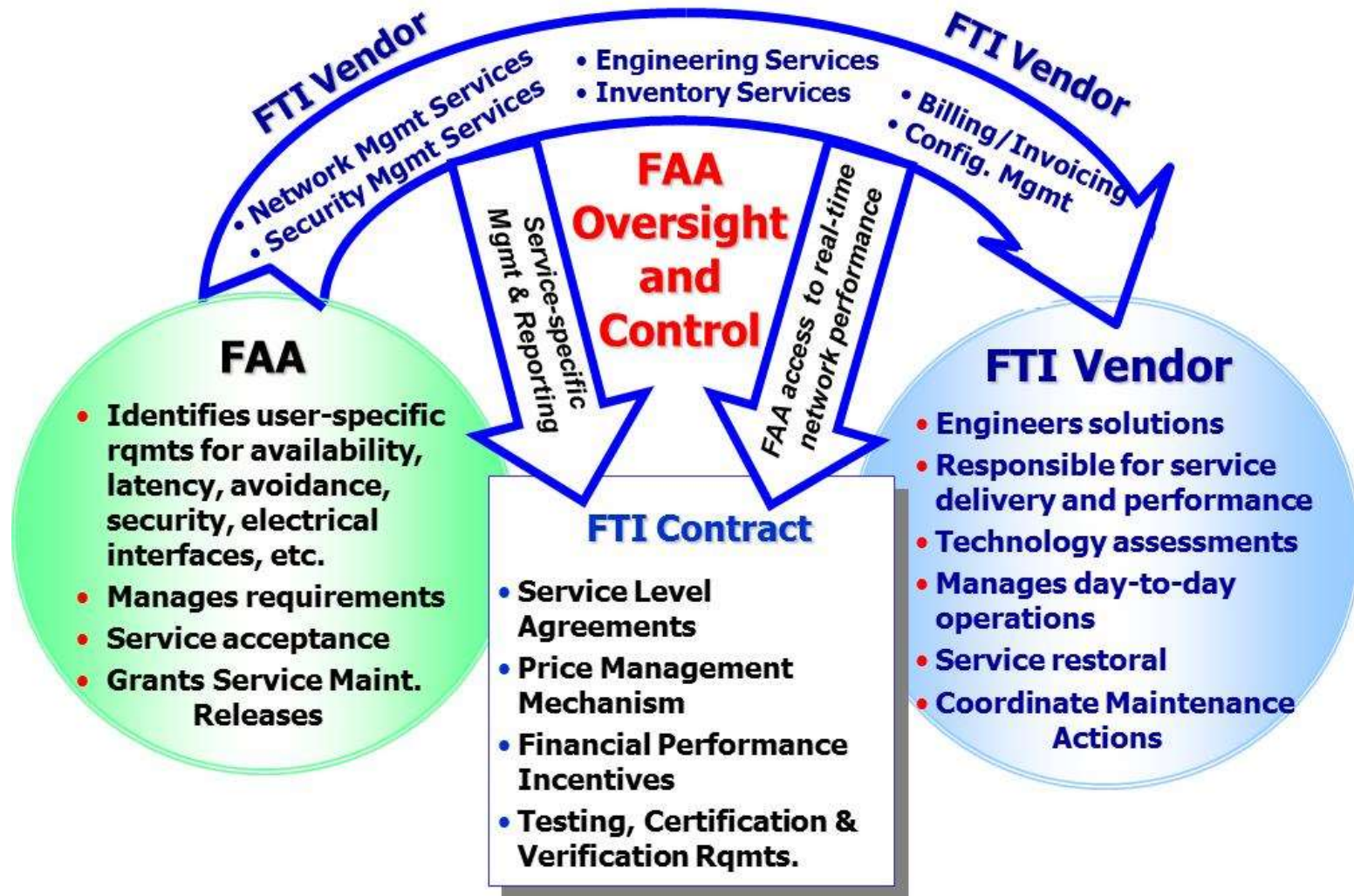
Key Attributes of FTI

- Provides a long-term, stable infrastructure for meeting FAA requirements for operational and agency communications
- Reduces dependence on FAA-owned equipment and provides the flexibility to take advantage of improvements in technology
- Implements enterprise-wide solution to information security assurance and other FAA-specific requirements
- Leverages commercial offerings and business practices
- Performance-based contract with a balance of positive and negative incentives
 - Award Fee to incentivize vendor to achieve FAA objectives
 - Service Level Agreement (SLA) that provides financial credits if services do not meet FAA requirements
- Defines mechanisms to ensure that the FAA pays market-competitive rates for the duration of the contract

FTI Service Paradigm

- **FAA focus is on defining the requirements for telecommunications services provided by FTI Contractor**
- **The FAA does not own, operate, or maintain any of the telecommunications equipment**
- **FTI Vendor is responsible for service provision including design, engineering, implementation, operations, maintenance, and network upgrades**
- **FTI Services Description Document (the FTI Spec) currently defines 100+ service classes**
 - Distinguished by RMA level, latency level, physical interface and other parameters
- **Enhanced security features such as encryption and firewalls can be ordered as optional features**

FTI Service Delivery Model



FTI Architectural Overview



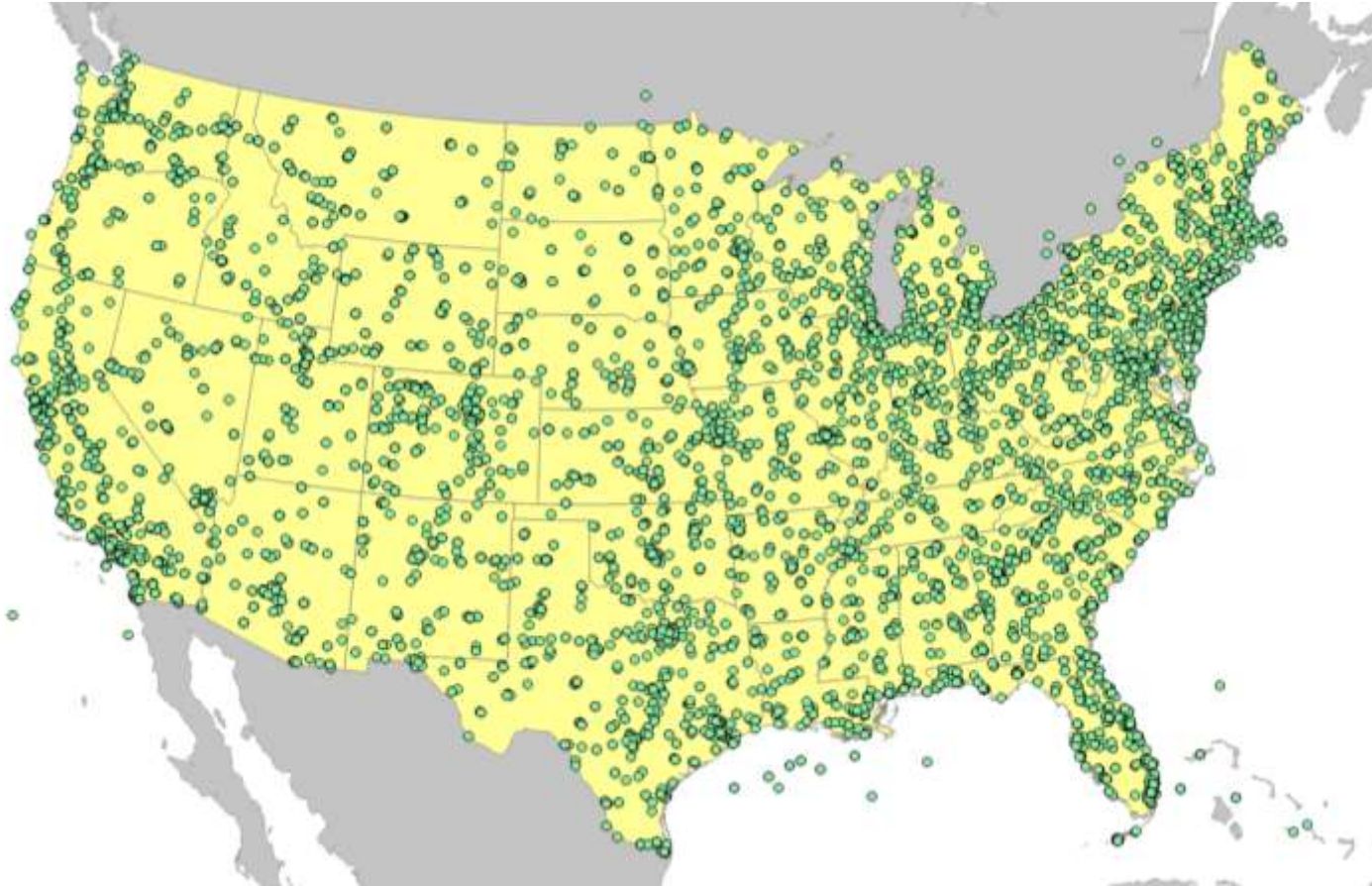
FTI Networks

- **The FTI Program includes two separate private networks meeting different requirements:**
 - One to provide connectivity between National Airspace System (NAS) Operational systems, and
 - One for agency / mission support applications
- **The separation is required to comply with FAA security policies to protect the NAS**
- **FTI provides a modern infrastructure that supports all commercial standard protocols**
- **Responsibility for technology insertion and keeping the network up-to-date lies with the contractor**
 - FAA not faced with technology obsolescence issues

Characteristics of Current FTI Architecture

- **FTI leverages efficient transmission technologies**
 - e.g. SONET, DWDM, etc.
- **FTI transmission infrastructure includes a private optical backbone connecting the largest air traffic control facilities**
- **Dedicated Network Operations Control Centers manage both the transmission backbone and IP network performance**
 - Control facilities include a primary facility in Melbourne, Florida and a backup facility in Atlanta, Georgia
- **FTI includes premise equipment installed at FAA Facilities**
 - Leverages digital network capabilities
 - Also supports legacy requirements for voice grade services, dedicated point-to-point circuits, etc.
- **The NAS includes remote facilities requiring high availability but typically lower bandwidth (see next slide)**

Geographic Spread of FAA Service Delivery Locations



About 75% of FAA service delivery locations are in remote locations with limited telco access

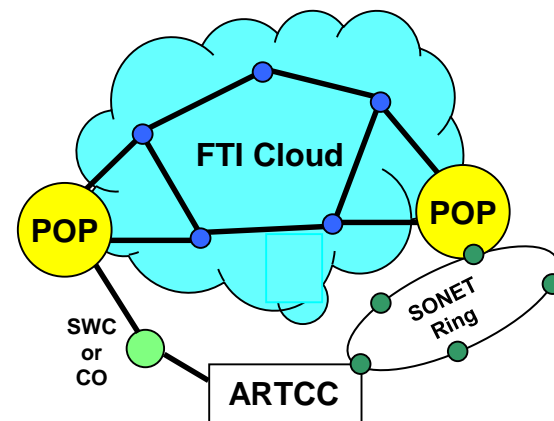
FTI Backbone Network Evolution



Initial FTI Backbone Architecture

- **Initially, the FTI NAS Operational Network backbone architecture included:**
 - Diverse access to two different long-haul carrier points of presence (POPs)
 - Access via SONET or point-to-point fiber or cable
 - Generally obtained in DS-1 or DS-3 increments
 - Transport on the backbone provided by two different long-haul carriers over ATM/Frame Relay trunks
 - Up to DS-3 in bandwidth

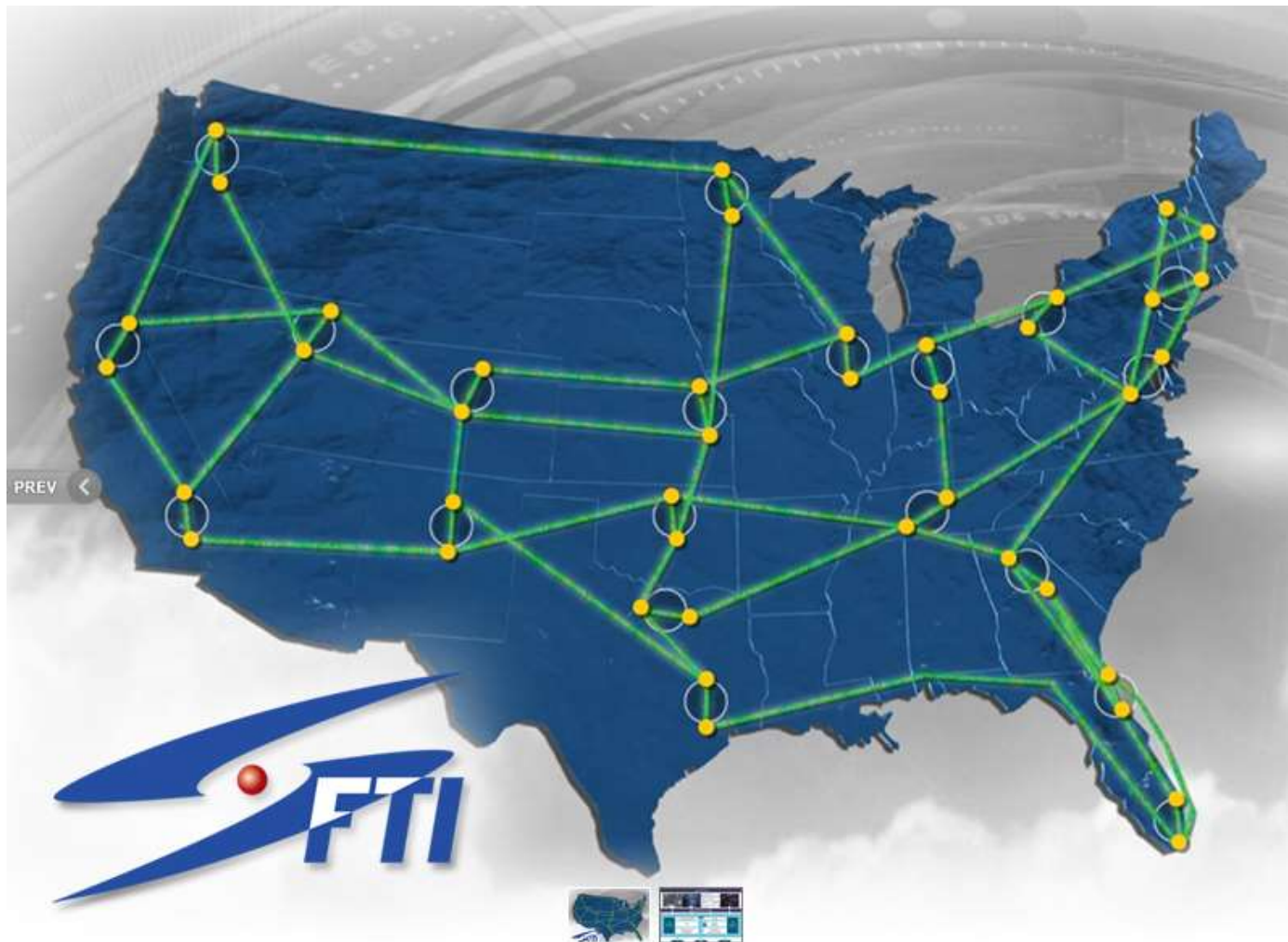
SWC – Serving Wire Center
CO – Central Office
SONET – Synchronous Optical Network



Optical Backbone Requirements

- **A major telecom carrier advised FTI Vendor of their intentions to get out of the ATM/FR transport business**
- **Additional bandwidth was needed to support Business Continuity Planning (BCP) concept of operations**
 - Requirement is to be able to achieve operational status within 3 weeks of a BCP event
 - FTI Optical Backbone supports BCP without carrier involvement
- **Evolving need for lower latency service classes for Operational IP traffic**
- **FAA needed to prepare for next wave of bandwidth demand coming with SWIM and other NextGen initiatives**
 - FAA was running out of capacity at some backbone sites

FTI Optical Backbone



Dual Core Requirements

- **Drivers:**

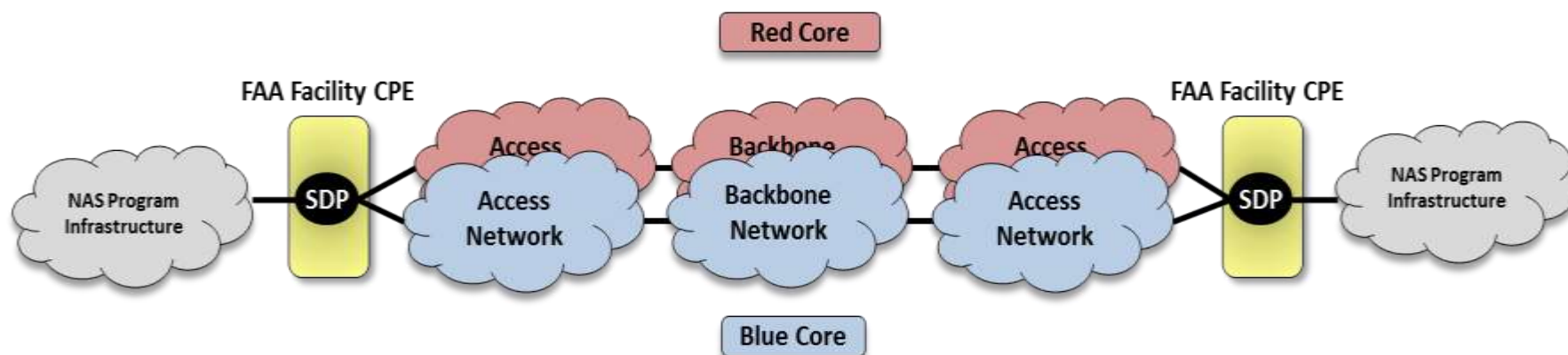
- A widespread NAS Operational IP (OPIP) network outage could adversely impact important, but non-safety critical programs
- As safety critical applications are added to the OPIP network, widespread outages would have greater impacts

- **Key attributes:**

- Provides separate transmission backbone and an independent networking core employing a separate isolated routing domain
- Protects against system-wide outages caused by disruption of routing protocols or degraded transmission backbone core
- Traffic replicator copies user packets and forwards over both cores
- Redundant copies eliminated at the destination

Dual Core Overview

- Used existing FTI OPIP network as one of the two cores (the Blue Core)
- Added a new second networking core (the Red Core)
- Dual Core is currently operational in the FTI NAS Operational IP Network



FTI Services Overview



FTI Service Offerings

- **Traditional Telecomm Services**
 - NAS Operational Network (TDM & IP)
 - FAA Mission Support – Administrative Network (IP)
- **Enterprise Messaging Services**
 - Implemented to support the requirements of the System-Wide Information Management (SWIM) program
- **Infrastructure Services**
 - Network Boundary Protection Services (NBPS)
 - NAS Enterprise Security Gateways (NESG) and dedicated NESG connectivity
 - Network Time Protocol / Precision Time Protocol (NTP/PTP)
 - Domain Name Services (DNS)
 - International User Portal (IUP)

FTI Service Provisioning

- **FTI Contractor is responsible for the end-to-end delivery and performance of the telecomm services**
- **FTI Contractor leases Local Exchange Carrier (LEC) and interexchange carrier (IXC) services required by the FAA**
- **In addition to traditional wireline services, FTI vendor provides other services where required to meet FAA connectivity requirements**
 - **Microwave services (8 GHz)**
 - Fixed earth stations and transportable earth stations deployable in emergency circumstances
 - **Satellite services (Ku-band and C-band)**
 - CONUS and Southern Caribbean

FTI Service Operations

- **FTI Contractor is responsible for engineering, provisioning, service verification, monitoring and control, and security**
- **FTI Contractor operates a...**
 - 24 X 7 Network Operations Control Center (NOCC)
 - 24 X 7 Security Operations Control Center, and a
 - Customer Support Service (available during normal business hours) for assistance with issues that do not have an operational impact

FTI NAS Operational Network



FTI NAS Operational Network

- **Completely private, highly secure network**
- **Provides service to 4,000+ sites, many in remote areas**
- **24,000 individual telecomm services**
- **Provides enhanced security functions (e.g., encryption, firewalling, intrusion protection/detection)**
- **Implements a dual-core architecture for NAS OPIP service to mitigate system-wide failures**

Traditional Telecomm Services

Service	Interfaces Supported
Low-speed digital (DDS)	<ul style="list-style-type: none">• DDS, RS-232, EIA-449, EIA-530(A), V.35, X.21
High-speed digital (bulk & fractional)	<ul style="list-style-type: none">• T-1 (1536 and 1544), T-3
Analog	<ul style="list-style-type: none">• VG-1/VG-3/VG-6/VG-8• 2-wire, 4-wire, FX, Ringdown
Internet Protocol (IP) data	<ul style="list-style-type: none">• EIA/TIA-232, EIA/TIA-449, EIA-530(A), V.35, T-1, T-3, Ethernet
Direct Digital Connect (DDC)	<ul style="list-style-type: none">• RS-232, EIA-449, EIA-530 (A),• Service Type 1, 2 & 3

FTI Service Classes

- **FTI Contract defines “service classes” to describe the basic types of telecomm services that must be provided by the contractor**
- **Service class characteristics include:**
 - RMA level
 - Latency level
 - Basic security level
 - Call set-up time (if applicable)
 - Call blocking limit (if applicable)
 - Interface type
- **The FTI contract defines over 100 distinct service classes**

FTI RMA Levels

RMA Level	Required Performance	Max Restoration Time	Max Restoration Time of Jeopardy
1	.9999971	6 Seconds	3 Hours
2	.9999719	58.8 Seconds	3 Hours
3	.9998478	8 Minutes	3 Hours
4	.9979452	3 Hours	N/A
5	.9972603	4 Hours	N/A
7 (FTI-SAT)	.9970000	24 Hours	N/A

FTI Diversity and Avoidance

- ***Diversity*** corresponds to redundant transmission paths that are physically and/or electrically separated for high availability services (RMA 1-3)
- ***Avoidance*** provides end-to-end physical and/or electrical separation between two or more services
- **IP service avoidance** means physical and/or electrical separation of the connectivity of SDPs to the OPIP backbone for two IP services
- **Diversity/Avoidance paths** are documented from the SDP to the carrier POP on both ends of the service and provided to the FAA as a monthly deliverable

FTI Mission Support Network



FAA Mission Support Network

- **Provides service to 1,000+ FAA facilities**
- **Provides Internet Access Points for FAA network traffic**
- **Provides dedicated transport for data replication between national data centers**
- **30,000+ Virtual Private Network (VPN) accounts**
- **Supports bandwidth-intensive applications**
 - FAA administrative services including: phone, email, training, payroll & internet access
 - Client based Video & Web Conferencing
 - Interactive web-based training

System Wide Information Management (SWIM) Enterprise Messaging Services



SWIM

Information Access to
Transform the Aviation
Community.



Enables new and cutting edge tools and applications.



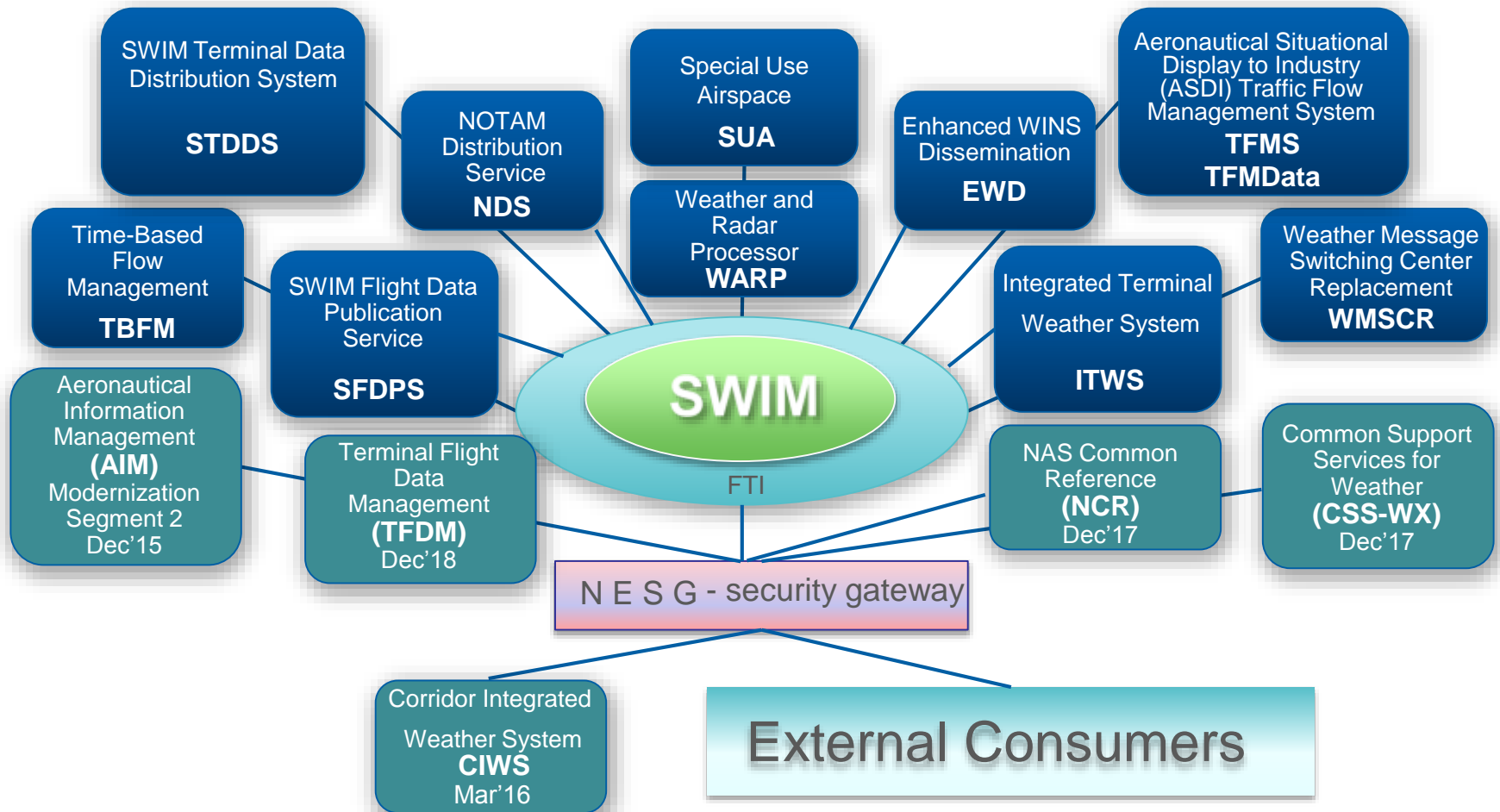
Facilitates an innovative, efficiently run airspace.



Saves operating and implementation costs.

- Replaces unique interfaces with modern standards-based data exchange
- Leverages a single interface to receive multiple data products
- Provides SWIM users access to information without directly connecting to another system
- Provides enterprise security for incoming and outgoing data
- Establishes a single point of contact for FAA data
- Establishes Enterprise Help Desk for SWIM operational consumer calls
- <http://www.faa.gov/nextgen/swim>

Status of SWIM Services



SWIM Infrastructure Deployment

NAS Enterprise Messaging Service (NEMS)



FAA / FTI Information Security



FAA WAN Security Policy Guidance (1370.95)

- External access to the NAS is limited to authorized security gateways
- Internet access is restricted to authorized Internet Access Points (IAPs)
 - Only the Mission Support Enterprise can access “www.” web services
 - NAS Enterprise system interfaces over the Internet are limited
 - Only Internet transport capability allowed (no web services)
 - NAS data flows require security controls while in transit
- External connections to a NAS system require approval from the FAA’s security organization
- Key WAN Security Policy implications
 - External interfaces are a NAS enterprise level issue
 - Security issues require resolution at three levels
 - Systems/Applications
 - Supporting NAS IT infrastructure
 - NAS IP Network

FTI Security Approach

- **Security is provided as a *feature* that accompanies the service**
- **FTI enables an enterprise-wide approach to information security management**
 - Real-time 24 X 7 monitoring of security incidents
 - Immediate reporting to the FAA
 - Coordinated response for incident resolution
- **Enhanced security levels can be ordered as required for specific applications such as virtual private networks**
- **FAA has implemented a series of Security Gateways to support FAA interface requirements with external users such as the airlines and DoD**

Boundary Protection

- **Provide NAS enterprise gateways to meet NAS functional and performance needs as part of NAS IT infrastructure**
 - Total of four gateways for basic boundary protection
- **Provide Core Security Services for NAS Systems/Applications' use to minimize impact on legacy systems**
- **Define multi-gateway operational concepts & management controls**
 - Implementation guidelines for security controls
 - NAS-wide operational & incident handling procedures

Key Near-Term FTI Challenge: *TDM-to-IP Migration*



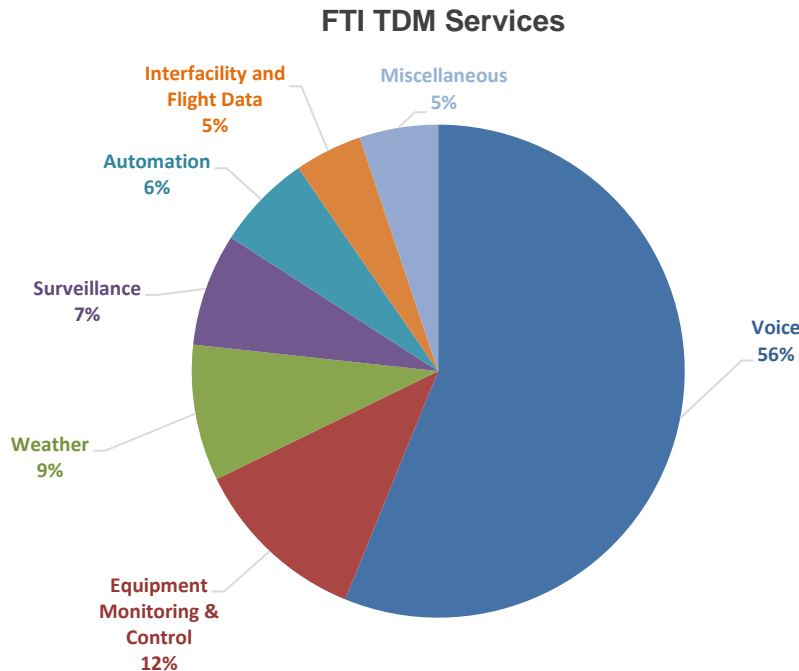
TDM-to-IP – Problem Description

- **Telecommunications carriers have petitioned the Federal Communications Commission (FCC) regarding their intent to completely discontinue services based on TDM technology by 2020**
 - Future service offerings will be based on Internet Protocol (IP) standards
 - Trials are currently underway in select locations
 - Success of trials will determine path for larger scale deployment
- **FAA NAS Operations highly dependent on TDM-based services today (See next chart)**

FTI NAS Operational Service Profile

- NAS is a large and diverse enterprise that relies on more than 23,000 telecomm services; 92% are TDM-based today

Service Implementation	Quantity	Percent of Total
TDM-based Services	21,532	92%
IP-based Services	1,935	8%
Total	23,467	

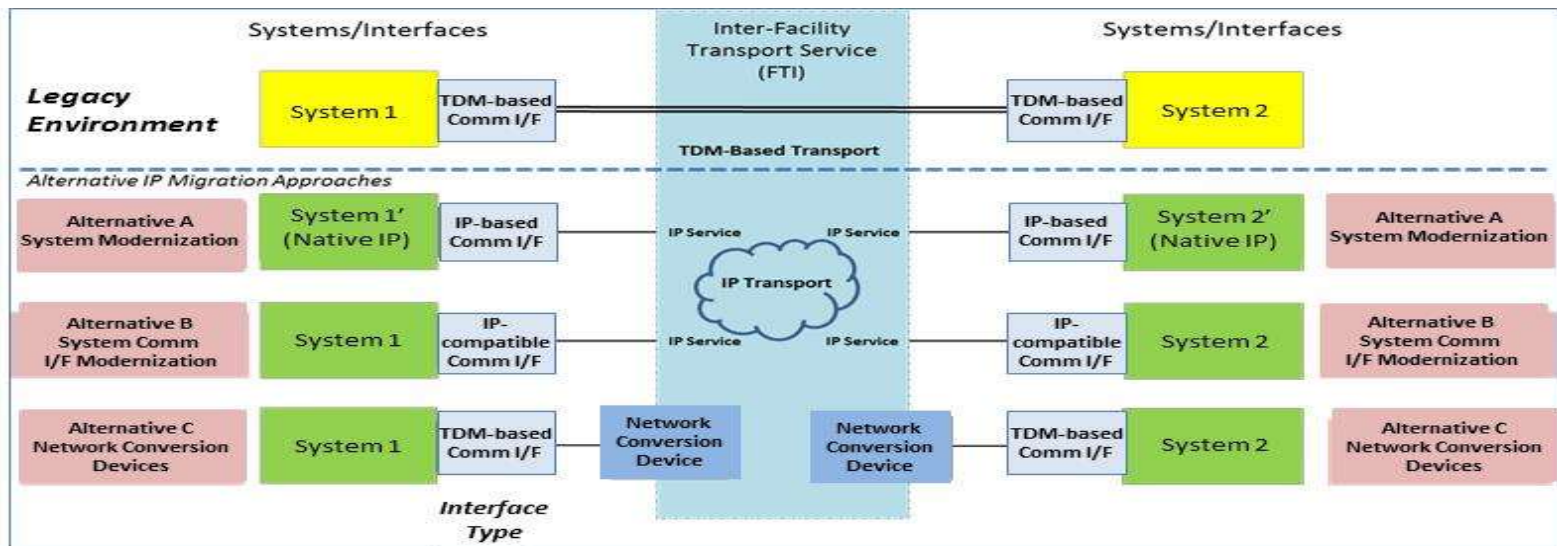


	Category of TDM-Based Services	# of services
	Voice (A/G, G/G, BUEC, RCO, Voice Switches)	12,093
	Equipment Monitoring & Control (RMLS)	2,502
	Weather (ASOS, TDWR, RVR's, IDS-R)	1,924
	Surveillance (Radars, Sensor)	1,592
	Automation (TAMR, STARS)	1,355
	Inter-Facility and Flight Data (FDAT, IDAT, FDIO)	955
	Other	1,111
	Total	21,532

FAA's TDM-to-IP Migration Strategy

Apply a multi-faceted approach that can be implemented in parallel depending on the circumstances

- A. System Modernization: Replace existing NAS systems with applications that use native IP for network communications
- B. System Communications Interface Modernization: The “base” NAS system remains as implemented but its communications interface is converted from TDM to IP
- C. Network Conversion Devices: Install TDM-to-IP conversion devices in the network to make the transition transparent to NAS systems not planned for modernization



TDM-to-IP Migration Challenges

- **FAA may not influence carrier decisions on replacement technologies (e.g., Carrier Ethernet (preferred) versus 4G Wireless) or where carriers will migrate first**
- **FAA facing a potential increase to its telecomm operating costs**
- **FAA may be forced to transition to IP-based services prior to 2020**
 - Depends on geographical phase-out pursued by carriers
 - Approach will likely vary across carriers
- **Creates uncertainty in the FAA's planning for the FTI-2 program**

Summary

- **The preceding slides have been intended to provide an overview of the FTI program and the evolution of the FAA's operating environment**
 - Provides a context for the FTI-2 program based on the premise that the scope of the existing FTI program will be the starting point for the scope of the FTI-2 program (although not all necessarily under a single contract)
- **They are also intended to provide a common starting point for the FTI-2 work groups that are being formed**
- **Moving forward, the FAA can provide more detailed briefings and special topic white papers as needed to promote the discussions within the individual work groups**